WHAT IS CLAIMED IS:

1. A method for making a field-effect semiconductor device comprising the steps of:

forming a gate electrode on a semiconductor layer comprising a gallium nitride-based compound semiconductor represented by the formula $Al_xIn_yGa_{1-x-y}N$, wherein $x + y = 1$, $0 \leq x \leq 1$, and $0 \leq y \leq 1$; and

forming a source electrode and a drain electrode by self-alignment using the gate electrode as a mask.

2. A method for making a field-effect semiconductor device according to Claim 1, wherein, in the step of forming the gate electrode, the gate electrode is formed into a predetermined pattern, and in the step of forming the source electrode and the drain electrode, the source electrode and the drain electrode are formed by vapor deposition using an electrode material.

3. A method for making a field-effect semiconductor device according to Claim 1, wherein the gate electrode has a T-shaped cross section, and the source electrode and the drain electrode are formed so as to be lower than the bottom face of an overhang of the T-shaped gate electrode.

4. A method for making a field-effect semiconductor device according to Claim 2, further comprising, after the step of forming the source electrode and the drain electrode, a step of removing the electrode material deposited on the gate electrode.

5. A method for making a field-effect semiconductor device according to Claim 2, wherein at least a part of the gate electrode comprises a high-melting-point metal.

6. A method for making a field-effect semiconductor device according to Claim 5, wherein the gate electrode has a multi-layered structure, and the multi-layered structure comprises a layer comprising the high-melting-point metal.

7. A method for making a field-effect semiconductor device according to either Claim 5 or 6, wherein the high-melting-point metal comprises at least one metal selected from the group consisting of Mo, Pt, W, Hf, and Cr.

8. A method for making a field-effect semiconductor device according to Claim 6, wherein the layer comprising the high-melting-point metal has a thickness of 200 nm or more.

9. A method for making a field-effect semiconductor device according to Claim 1, wherein the semiconductor layer comprises a spacer layer, a Si-containing carrier-supplying layer, and a cap layer; the spacer layer, the Si-containing carrier-supplying layer, and the cap layer comprising the gallium nitride-based compound semiconductor represented by the formula $Al_xIn_yGa_{1-x-y}N$; and the spacer layer, the Si-containing carrier-supplying layer, and the cap layer are deposited in that order on a GaN-based channel layer,

wherein the gate electrode, the source electrode, and the drain electrode are formed on the cap layer.

10. A field-effect semiconductor device comprising:

a semiconductor layer comprising a gallium nitride-based compound semiconductor represented by the formula $Al_xIn_yGa_{1-x-y}N$, wherein $x + y = 1$, $0 \leq x \leq 1$, and $0 \leq y \leq 1$;

a gate electrode formed on the semiconductor layer; and

a source electrode and a drain electrode formed by self-alignment using the gate electrode as a mask.

11. A field-effect semiconductor device according to Claim 10, wherein the gate electrode has a predetermined pattern, and the source electrode and the drain electrode are formed by vapor deposition using an electrode material.

12. A field-effect semiconductor device according to Claim 10, wherein the gate electrode has a T-shaped cross section, and the source electrode and the drain electrode are lower than the bottom face of an overhang of the T-shaped gate electrode.

13. A field-effect semiconductor device according to Claim 11, wherein the electrode material deposited on the gate electrode is removed after the formation of the source electrode and the drain electrode.

14. A field-effect semiconductor device according to Claim 11, wherein at least a part of the gate electrode comprises a high-melting-point metal.

15. A field-effect semiconductor device according to Claim 14, wherein the gate electrode has a multi-layered structure, and the multi-layered structure comprises a layer comprising the high-melting-point metal.

16. A field-effect semiconductor device according to either Claim 14 or 15, wherein the high-melting-point metal comprises at least one metal selected from the group consisting of Mo, Pt, W, Hf, and Cr.

17. A field-effect semiconductor device according to Claim 15, wherein the layer comprising the high-melting-point metal has a thickness of 200 nm or more.

18. A field-effect semiconductor device according to Claim 10, wherein the semiconductor layer comprises a spacer layer, a Si-containing carrier-supplying layer, and a cap layer; the spacer layer, the Si-containing carrier-supplying layer, and the cap layer comprising the gallium nitride-based compound semiconductor represented by the formula $Al_xIn_yGa_{1-x-y}N$,

wherein the field-effect semiconductor device further comprises a GaN-based channel layer, and the spacer layer, the Si-containing carrier-supplying layer, and the cap layer are deposited in that order on the GaN-based channel layer,

wherein the gate electrode, the source electrode, and the drain electrode are formed on the cap layer.